Source and Accuracy of Estimates for *Poverty in the United States: 2001*

SOURCES OF DATA

Most estimates in *Poverty in the United States: 2001* come from data obtained in March of years 1968 through 2002 in the Current Population Survey (CPS). The U.S. Census Bureau conducts the survey every month, although this report bases its poverty estimates on income data collected in the CPS Annual Demographic Supplement (ADS). Most of the ADS data collection occurs in March, but because of the sample expansion, some data collection occurs in February and April (see CPS sections for more information on the sample expansion). The March survey thus uses two sets of questions: the basic CPS and the supplement.

The Census Bureau used data from various sources in developing experimental poverty measures. Specifically, we combined data from the American Housing Survey (AHS), the Income Survey Development Program (ISDP), and the Internal Revenue Service (IRS) with CPS data to create simulations of taxes paid, number of tax filing units, adjusted gross income, and other tax characteristics for the March 2002 CPS.

The experimental poverty measures in *Poverty in the United States: 2001* used tax and noncash benefit data in their computation. Tax data came from the State Tax Handbook from the Commerce Clearing House. To compute noncash benefits, we used data from the U.S. Department of Agriculture (USDA), the Health Care Financing Administration (HCFA), and the Department of Housing and Urban Development (HUD).

A description of the sources of data we used to derive these estimates follows. Except for the CPS, these descriptions are brief. See Current Population Reports, Series P60-186RD, *Measuring the Effect of Benefits and Taxes on Income and Poverty: 1992,* and publications on the appropriate surveys for more details.

American Housing Survey. The Census Bureau collects housing data for the Department of Housing and Urban Development. The population covered by the sample for the AHS (called the Annual Housing Survey before 1984) includes all housing units in the United States. For a more detailed description of the sample design, see the report Current Housing Reports, Series H150- 89, *The American Housing Survey for the United States in 1989,* U.S. Department of Commerce.

The AHS is no longer conducted in even-numbered years, so we based the property tax estimates in this report on the 1995 AHS. Also, for the noncash estimates, we used the 1985 AHS data in a model to estimate the value of public housing. For more details on the AHS model used to estimate public and subsidized housing values, please see Appendix B of Current Population Reports, Series P60-186RD, *Measuring the Effect of Benefits and Taxes on Income and Poverty: 1992*.

Income Survey Development Program. The ISDP was the research and development phase for the Survey of Income and Program Participation (SIPP). The Census Bureau used the ISDP to examine and resolve design, operational, and technical issues for SIPP. The household sample for the 1979 ISDP was a nationwide, multiple frame sample. The majority of sample households in the ISDP came from addresses contacted in the 1976 Survey of Income and Education.

Statisticians selected the remainder of sample households from a reserve file of sample cases maintained by the Census Bureau. For a more detailed description of this sample design, see the report *Wage and Salary Data From the Income Survey Development Program: 1979 (Preliminary Data From Interview Period One),* Current Population Reports, Special Studies, Series P-23, No. 118.

Internal Revenue Service data. Much of the IRS data in this report came from the Statistics of Income (SOI) series, in particular the SOI Bulletin *Individual Income Tax Returns, Preliminary Data: 2000,* Spring 2002. This report, based on a sample drawn from all tax returns filed in 2001, presents information on taxpayers' incomes, exemptions, deductions, credits, and taxes.

Data from other sources. The *State Tax Handbook,* October 1, 1991, from the Commerce Clearing House, includes information on state tax systems. We updated these data to reflect changes in state income tax rates.

Much of the data on cash and noncash benefits are from administrative records. Values of school lunches and food stamps are from USDA unpublished data. Medicaid and medicare data come from HCFA unpublished records. Also, USDA and HUD data are used to compute

medicaid and medicare values. For more details, see Appendix B of Current Population Reports, Series P60-186RD, *Measuring the Effect of Benefits and Taxes on Income and Poverty: 1992*.

Basic CPS. The basic CPS collects primarily labor force data about the civilian noninstitutional population. Field representatives ask questions concerning labor force participation about each member 15 years old and over in every sample household.

The present monthly CPS sample was selected from the 1990 Decennial Census files with coverage in all 50 states and the District of Columbia. The sample is continually updated to account for new residential construction. To obtain the sample, the United States was divided into 2,007 geographic areas. In most states, a geographic area consisted of a county or several contiguous counties. In some areas of New England and Hawaii, minor civil divisions are used instead of counties. These 2,007 geographic areas were then grouped into 754 strata, and one geographic area was selected from each stratum.

About 60,000 occupied households are eligible for interview every month out of the 754 strata. Interviewers are unable to obtain interviews at about 4,500 of these units. This occurs when the occupants are not found at home after repeated calls or are unavailable for some other reason.

The number of households that are eligible for interview in the basic CPS increased from 50,000 to 60,000 in July of 2001. This increase in the number of eligible households is due to the implementation of the State Children's Health Insurance Program (SCHIP) sample expansion. The SCHIP sample expansion increased the monthly CPS sample in states with high sampling errors for low-income uninsured children. With the increase in eligible households, the number of units where interviewers were unable to obtain an interview increased from 3,200 to 4,500.

Since the introduction of the CPS, the Census Bureau has redesigned the CPS sample several times. These redesigns have improved the quality and accuracy of the data and have satisfied changing data needs. The Census Bureau completely implemented the most recent changes in July 1995.

Table 1 summarizes changes in the CPS designs for the years in which data appear in this report.

CPS March supplement. In addition to the basic CPS questions, field representatives asked supplementary questions in March about health insurance coverage, money income received during the previous calendar year, and place of residence 1 year ago.

Table 1.
Description of the March Current Population Survey

Time period	Number of sample areas	Housing units eligible[1]	
		Interviewed	Not interviewed
1996 to 2002	754	46,800	3,200
1995	792	56,700	3,300
1990 to 1994	729	57,400	2,600
1989	729	53,600	2,500
1986 to 1988	729	57,000	2,500
1985	[2]629/729	57,000	2,500
1982 to 1984	629	59,000	2,500
1980 to 1981	629	65,500	3,000
1977 to 1979	614	55,000	3,000
1973 to 1976	461	46,500	2,500
1972	449	45,000	2,000
1968 to 1971	449	48,000	2,000

[1]Excludes about 12,500 households added because of the SCHIP sample expansion, 1,300 of which are not interviewed. (See "CPS March Supplement.")
[2]The Census Bureau redesigned the CPS following the 1980 Decennial Census of Population and Housing. During phase-in of the new design, housing units from the new and old designs were in sample.
Source: U.S. Census Bureau, Demographic Statistical Methods Division.

To obtain more reliable data for certain minority groups, the March Supplement sample includes 21,000 eligible housing units in addition to the 60,000 eligible housing units from the basic CPS. Included in this 21,000 housing unit increase are Hispanic[1] households identified the previous November and following April, non-Hispanic non-White households identified the previous November, and non-Hispanic White households with children under 19 years of age identified in the previous November and following April. This March Supplement sample increase of 21,000 was first included in March 2001 for testing purposes and in March 2002 for reporting purposes.

For more information about the households eligible for the March supplement, please see Chapters 2 and 3 and Appendix J of:

Technical Paper 63RV, *Current Population Survey: Design and Methodology*, U.S. Census Bureau, U.S. Department of Commerce, 2002.

CPS estimation procedure. This survey's estimation procedure adjusts weighted sample results to agree with independent estimates of the civilian noninstitutional population of the United States by age, sex,

[1]This report shows information on the Hispanic population collected in the 50 states and the District of Columbia, and therefore, does not include residents of Puerto Rico. Hispanics may be of any race.

Table 2.
March CPS Coverage Ratios

Age	Non-Black		Black		All people		
	Male	Female	Male	Female	Male	Female	Total
0 to 14 years	0.929	0.964	0.850	0.838	0.916	0.943	0.929
15 years	0.933	0.895	0.763	0.824	0.905	0.883	0.895
16 to 19 years	0.881	0.891	0.711	0.802	0.855	0.877	0.866
20 to 29 years	0.847	0.897	0.660	0.811	0.823	0.884	0.854
30 to 39 years	0.904	0.931	0.680	0.845	0.877	0.920	0.899
40 to 49 years	0.928	0.966	0.816	0.911	0.917	0.959	0.938
50 to 59 years	0.953	0.974	0.896	0.927	0.948	0.969	0.959
60 to 64 years	0.961	0.941	0.954	0.953	0.960	0.942	0.950
65 to 69 years	0.919	0.972	0.982	0.984	0.924	0.973	0.951
70 years and older	0.993	1.004	0.996	0.979	0.993	1.002	0.998
15 years and older	0.914	0.945	0.767	0.874	0.898	0.927	0.918
0 years and older	0.918	0.949	0.793	0.864	0.902	0.931	0.921

Source: U.S. Census Bureau, Demographic Statistical Methods Division.

race, and Hispanic/non-Hispanic ancestry, and state of residence. The independent estimates are based on:

- The 2000 Decennial Census of Population and Housing.
- Statistics on births, deaths, immigration, and emigration.
- Statistics on the size of the armed forces.

The independent population estimates used for 2001 and 2002 (poverty estimates for 2000 and 2001) are based on updates to controls established by the 2000 decennial census. The 1993 to 2000 population estimates (poverty estimates for 1992 to 1999) are based on updates to controls established by the 1990 decennial census. Data previous to 1993 are based on independent population estimates from the latest available decennial census data. See the text box on page 1 of *Poverty in the United States: 2001* for more information. The independent population estimates include some, but not all, undocumented immigrants.

ACCURACY OF ESTIMATES

Since the CPS estimates come from a sample, they may differ from figures from a complete census using the same questionnaires, instructions, and enumerators. A sample survey estimate has two possible types of error: sampling and nonsampling. The accuracy of an estimate depends on both types of error, but the full extent of the nonsampling error is unknown. Consequently, one should be particularly careful when interpreting results based on a relatively small number of cases or on small differences between estimates. The standard errors for CPS estimates primarily indicate the magnitude of sampling error. They also partially measure the effect of some nonsampling errors in responses and enumeration, but do not measure systematic biases in the data. (Bias is the average over all possible samples of the differences between the sample estimates and the true value.)

Nonsampling variability. We can attribute nonsampling errors to several sources including the following:

- Inability to obtain information about all cases in the sample.
- Definitional difficulties.
- Differences in the interpretation of questions.
- Respondent inability or unwillingness to provide correct information.
- Respondent inability to recall information.
- Errors made in data collection, such as in recording or coding the data.
- Errors made in processing the data.
- Errors made in estimating values for missing data.
- Failure to represent all units with the sample (undercoverage).

CPS undercoverage results from missed housing units and missed people within sample households. Overall CPS undercoverage is estimated to be about 8 percent. Undercoverage varies with age, sex, and race. Generally, undercoverage is larger for males than for females and larger for Blacks and other races combined than for Whites. As described previously, ratio estimation to independent age-sex-race-Hispanic population controls partially corrects for bias due to undercoverage. However, biases exist in the estimates to the extent that missed people in missed households or

missed people in interviewed households have different characteristics from those of interviewed people in the same age-sex-race-Hispanic origin group.

A common measure of survey coverage is the coverage ratio, the estimated population before post-stratification divided by the independent population control. Table 2 shows CPS coverage ratios for age-sex-race groups for a typical month. The CPS coverage ratios can exhibit some variability from month to month, but these are a typical set of coverage ratios.

Answers to questions about money income often depend on the memory or knowledge of one person in a household. Recall problems can cause underestimates of income in survey data, because it is easy to forget minor or irregular sources of income. Respondents may also misunderstand what the Census Bureau considers money income or may simply be unwilling to answer these questions correctly because the questions are considered too personal. See Appendix C, Current Population Reports, Series P60-184, *Money Income of Households, Families, and Persons in the United States: 1992* for more details.

For additional information on nonsampling error including the possible impact on CPS data when known, refer to Statistical Policy Working Paper 3, *An Error Profile: Employment as Measured by the Current Population Survey*, Office of Federal Statistical Policy and Standards, U.S. Department of Commerce, 1978 and Technical Paper 63RV, *The Current Population Survey: Design and Methodology*, U.S. Census Bureau, U.S. Department of Commerce, 2002.

Comparability of data. Data obtained from the CPS and other sources are not entirely comparable. This results from differences in interviewer training and experience and in differing survey processes. This is an example of nonsampling variability not reflected in the standard errors. Therefore, caution should be used when comparing results from different sources.

A number of changes were made in data collection and estimation procedures beginning with the January 1994 CPS. The major change was the use of a new questionnaire. The Bureau of Labor Statistics redesigned the questionnaire to measure the official labor force concepts more precisely, to expand the amount of data available, to implement several definitional changes, and to adapt to a computer-assisted interviewing environment. The Census Bureau modified the March supplemental income questions for adaptation to computer-assisted interviewing, but did not change definitions and concepts. Because of these and other changes, one should use caution when comparing estimates from data collected before 1994 with estimates from data collected in 1994 and later.

Data users should also use caution when comparing estimates for 2000 and 2001 in *Poverty in the United States: 2001* (which reflect 2000 census-based population controls) with estimates for 1992 to 1999 (from March 1993 CPS to March 2000 CPS), which reflect 1990 census-based population controls and with estimates for 1991 (from March 1992 CPS) and earlier years, which reflect 1980 census-based population controls. See the text box on page 1 of *Poverty in the United States: 2001* for more information. This change in population controls had relatively little impact on summary measures, such as averages, medians, and percentage distributions. It did have a significant impact on levels. For example, use of 2000-based population controls results in about a 1 percent increase in the civilian noninstitutional population and in the number of families and households. Thus, estimates of levels for data collected in 2001 and later years will differ from those for earlier years by more than what could be attributed to actual changes in the population. These differences could be disproportionately greater for certain sub-population groups than for the total population.

Caution should also be used when comparing Hispanic estimates over time. No independent population control totals for people of Hispanic ancestry were used before 1985.

Based on the results of each decennial census, the Census Bureau gradually introduces a new sample design for the CPS. During this phase-in period, the Census Bureau collects CPS data from sample designs based on different censuses. While most CPS estimates have been unaffected by this mixed sample, geographic estimates are subject to greater error and variability. Users should exercise caution when comparing estimates across years for metropolitan/nonmetropolitan categories. For more information, see Appendix C, Current Population Reports, Series P60-193, *Money Income in the United States: 1995 (With Separate Data on Valuation of Noncash Benefits).*

Note when using small estimates. The Census Bureau shows summary measures (such as medians and percentage distributions) only when the base is 75,000 or greater. Because of the large standard errors involved, summary measures would probably not reveal useful information when computed on a smaller base. However, we display estimated numbers even though the relative standard errors of these numbers are larger than those for corresponding percentages. These

Table 3.
CPS Standard Error Parameters for Income and Nonincome Characteristics: 2001

Characteristics	Total or White		Black		Hispanic	
	a	b	a	b	a	b
BELOW POVERTY LEVEL						
People						
Total	-0.000019	5,282	-0.000147	5,282	-0.000141	5,282
Male	-0.000038	5,282	-0.000317	5,282	-0.000269	5,282
Female	-0.000037	5,282	-0.000274	5,282	-0.000279	5,282
Age						
Under 15	-0.000067	4,072	-0.000413	4,072	-0.000367	4,072
Under 18	-0.000056	4,072	-0.000348	4,072	-0.000287	4,072
15 and over	-0.000024	5,282	-0.000203	5,282	-0.000201	5,282
15 to 24	-0.000051	1,998	-0.000345	1,998	-0.000197	1,998
25 to 44	-0.000024	1,998	-0.000191	1,998	-0.000112	1,998
45 to 64	-0.000031	1,998	-0.000285	1,998	-0.000124	1,998
65 and over	-0.000059	1,998	-0.000713	1,998	-0.000377	1,998
Households, Families, and Unrelated Individuals						
Total	+0.000052	1,243	+0.000052	1,243	+0.000052	1,243
ALL INCOME LEVELS						
People						
Total	-0.000006	1,249	-0.000055	1,430	-0.000054	1,430
Male	-0.000012	1,249	-0.000123	1,430	-0.000104	1,430
Female	-0.000011	1,249	-0.000099	1,430	-0.000108	1,430
Age						
15 to 24	-0.000032	1,249	-0.000247	1,430	-0.000141	1,430
25 to 44	-0.000015	1,249	-0.000137	1,430	-0.000080	1,430
45 to 64	-0.000019	1,249	-0.000204	1,430	-0.000089	1,430
65 and over	-0.000037	1,249	-0.000511	1,430	-0.000270	1,430
Households, Families, and Unrelated Individuals						
Total	-0.000005	1,140	-0.000048	1,245	-0.000047	1,245
NONINCOME CHARACTERISTICS						
People						
Employment status	-0.000008	1,586	-0.000154	3,296	-0.000187	3,296
Educational attainment	-0.000005	1,206	-0.000052	1,364	-0.000035	922
Health insurance	-0.000004	1,115	-0.000038	1,354	-0.000027	997
Total, Marital Status, Other						
Some household members	-0.000009	2,652	-0.000106	3,809	-0.000102	3,809
All household members	-0.000011	3,222	-0.000156	5,617	-0.000150	5,617
Households, Families, and Unrelated Individuals						
Total	-0.000005	1,052	-0.000036	952	-0.000036	952

Note: To obtain parameters prior to 2001, multiply by the appropriate factor in Table 4. For nonmetropolitan residence categories, multiply the a and b parameters by 1.5. For foreign-born and noncitizen characteristics for Total and White, multiply the a and b parameters by 1.3. No adjustment is necessary for foreign-born and noncitizen characteristics for Blacks and Hispanics. For regional estimates, multiply the a and b parameters by 0.89, 0.91, 1.14, and 1.23 for Northeast, Midwest, South, and West, respectively.

Source: U.S. Census Bureau, Demographic Statistical Methods Division.

Table 4.
CPS Factors to Apply to a and b Parameters for Estimates Prior to 2001

Characteristic	Factor
NON-HISPANIC	
2000 (expanded)	1.00
1995 to 2000 (basic)	1.96
1989 to 1994	1.80
1988	2.00
1981 to 1987	1.69
1967 to 1980	1.47
HISPANIC	
2000 (expanded)	1.00
1995 to 2000 (basic)	1.96
1989 to 1994	1.80
1988	2.33
1984 to 1987	1.47

Source: U.S. Census Bureau, Demographic Statistical Methods Division.

smaller estimates permit combinations of the categories to suit data users' needs. Take care in the interpretation of small differences. For instance, even a small amount of nonsampling error can cause a borderline difference to appear significant or not, thus distorting a seemingly valid hypothesis test.

Estimation of median incomes. The Census Bureau has changed the methodology for computing median income over the past few years. The Census Bureau has computed medians using either Pareto interpolation or linear interpolation. Currently, we are using linear interpolation to estimate all medians. Pareto interpolation assumes a decreasing density of population within an income interval; whereas, linear interpolation assumes a constant density of population within an income interval. The Census Bureau calculated estimates of median income and associated standard errors for 1979 through 1987 using Pareto interpolation if the estimate was larger than $20,000 for people or $40,000 for families and households. This is because the width of the income interval containing the estimate is greater than $2,500.

We calculated estimates of median income and associated standard errors for 1976, 1977, and 1978 using Pareto interpolation if the estimate was larger than $12,000 for people or $18,000 for families and households. This is because the width of the income interval containing the estimate is greater than $1,000. We calculated all other estimates of median income and associated standard errors for 1976 through 2001 and almost all of the estimates of median income and associated standard errors for 1975 and earlier were calculated using linear interpolation.

Thus, use caution when comparing median incomes above $12,000 for people or $18,000 for families and households for different years. Median incomes below those levels are more comparable from year to year since they have always been calculated using linear interpolation. For an indication of the comparability of medians calculated using Pareto interpolation with medians calculated using linear interpolation, see Series P-60, No. 114, *Money Income in 1976 of Families and Persons in the United States*.

Sampling variability. Sampling variability is variation that occurred by chance because a sample was surveyed rather than the entire population. Standard errors, as calculated by methods described in **Standard errors and their use**, are primarily measures of sampling variability, but they may include some nonsampling error.

Standard errors and their use. Data users must use a number of approximations to derive, at a moderate cost, standard errors applicable to all the estimates in this report. Instead of providing an individual standard error for each estimate, two parameters, a and b, have been provided to calculate standard errors for each type of characteristic.

Table 3 provides standard error parameters for various types of characteristics. Table 4 provides factors to approximate CPS standard error parameters for estimates prior to 2001. Table 5 provides CPS Hispanic parameters for estimates prior to 1984. Table 6 provides CPS parameters for income and nonincome characteristics for Asian and Pacific Islanders and American Indians and Alaskan Natives. Table 7 contains the year-to-year CPS correlation coefficients for income characteristics.

The sample estimate and its standard error enable one to construct a confidence interval, a range that would include the average result of all possible samples with a known probability. For example, if all possible samples were surveyed under essentially the same general conditions and using the same sample design, and if an estimate and its standard error were calculated from each sample, then approximately 90 percent of the intervals from 1.645 standard errors below the estimate to 1.645 standard errors above the estimate would include the average result of all possible samples.

A particular confidence interval may or may not contain the average estimate derived from all possible samples. However, one can say with specified confidence that the interval includes the average estimate calculated from all possible samples.

Table 1 in *Poverty in the United States: 2001* lists estimates followed by a number labeled "90-percent C.I. (±)." This number can be added to and subtracted from the estimate to calculate upper and lower bounds of the 90-percent confidence interval. For example, for the statement "the poverty rate for the United States rose to 11.7 percent in 2001," the 90-percent confidence interval for the estimate, 11.7 percent, is 11.7 (±0.2) percent, or 11.5 percent to 11.9 percent.

Data users may also use standard errors to perform hypothesis testing. This is a procedure for distinguishing between population parameters using sample estimates. One common type of hypothesis appearing in this report is that two population parameters are different. An example of this would be comparing the poverty rate of Black families with the poverty rate of White non-Hispanic families.

One can perform tests at various levels of significance. The significance level of a test is the probability of concluding that the characteristics are different when, in fact, they are the same. All statements of comparison in the text were tested at the 0.10 level of significance or better. This means that the absolute value of the estimated difference between characteristics is greater than or equal to 1.645 times the standard error of the difference. Table 1 in *Poverty in the United States: 2001* displays an asterisk next to significant differences. Please observe that the absolute value of the significant difference is greater than 1.645 times the standard error (labeled "90 percent C.I. (±)").

The Census Bureau uses 90-percent confidence intervals and 0.10 levels of significance to determine statistical validity. Consult standard statistical textbooks for alternative criteria.

Standard errors of estimated numbers. One can obtain the approximate standard error, s_x, of an estimated number shown in this report by using the formula:

$$s_x = \sqrt{ax^2 + bx} \qquad (1)$$

Here x is the size of the estimate and a and b are the parameters in Table 3 through 6 associated with the particular type of characteristic. When calculating standard errors for numbers from cross-tabulations involving different characteristics, use the set of parameters for the characteristic which will give the largest standard error.

Illustration. In *Poverty in the United States: 2001*, Table 1 shows that there were 32,907,000 people below poverty in 2001. Use the appropriate parameters from Table 3 and formula (1) to get

Number, x	32,907,000
a parameter	-0.000019
b parameter	5,282
Standard error	391,000
90-percent conf. int.	33,550,000 to 32,264,000

The standard error is calculated as

$$s_x = \sqrt{(-0.000019)(32{,}907{,}000)^2 + (5{,}282)(32{,}907{,}000)} = 391{,}000$$

The 90-percent confidence interval is calculated as 32,907,000 ± 1.645 x 391,000.

A conclusion that the average estimate derived from all possible samples lies within a range computed in this way would be correct for roughly 90 percent of all possible samples.

Standard errors of estimated percentages. The reliability of an estimated percentage, computed using sample data from both numerator and denominator, depends on the size of the percentage and its base. Estimated percentages are relatively more reliable than the corresponding estimates of the numerators of the percentages, particularly if the percentages are 50 percent or more. When the numerator and denominator of the percentage are in different categories, use the parameter from Table 3 or 6 indicated by the numerator. One can obtain the approximate standard error, $s_{x,p}$, of an estimated percentage by using the formula

$$s_{x,p} = \sqrt{\frac{b}{x} p(100 - p)} \qquad (2)$$

Here x is the total number of people, families, households, or unrelated individuals in the base of the percentage, p is the percentage ($0 \le p \le 100$), and b is the parameter in Table 3 or 6 associated with the characteristic in the numerator of the percentage.

Illustration. In *Poverty in the United States: 2001*, Table 1 shows that of the 32,907,000 people below the poverty level in 2001, 15,271,000, or 46.4 percent were White non-Hispanic. Use the appropriate parameter from Table 3 and formula (2) to get

Percentage, p	46.4
Base, x	32,907,000
b parameter	5,282
Standard error	0.63
90-percent conf. int.	45.4 to 47.4

The standard error is calculated as

$$s_{x,p} = \sqrt{\frac{5{,}282}{32{,}907{,}000}(46.4)(100-46.4)} = 0.63$$

The 90-percent confidence interval is calculated as 46.4 ± 1.645 x 0.63.

Standard error of a difference. The standard error of the difference between two sample estimates is approximately equal to

$$s_{x-y} = \sqrt{s_x^2 + s_y^2 - 2rs_x s_y} \qquad (3)$$

where s_x and s_y are the standard errors of the estimates, x and y. The estimates can be numbers, percentages, ratios, etc. Table 7 contains the correlation coefficient, r, for year-to-year comparisons for CPS income estimates of numbers and proportions. For other comparisons, assume that r equals zero. Making this assumption will result in accurate estimates of standard errors for the difference between two estimates of the same characteristic in two different areas, or for the difference between separate and uncorrelated characteristics in the same area. However, if there is a high positive (negative) correlation between the two characteristics, the formula will overestimate (underestimate) the true standard error.

Illustration. In *Poverty in the United States: 2001*, Table 1 shows that the number of people below the poverty level in 2001 was 32,907,000 and in 2000 was 31,581,000. The apparent difference is 1,326,000. Use the appropriate parameters and factors from Table 3 and Table 4 and formulas (1) and (3) to get

	x	y	difference
Estimate	32,907,000	31,581,000	1,326,000
a parameter	-0.000019	-0.000019	-
b parameter	5,282	5,282	-
r	-	-	.45
Standard error	391,000	385,000	407,000
90-percent conf. int.	33,550,000 to 32,264,000	30,948,000 to 32,214,000	656,000 to 2,000,000

The standard error of the difference is calculated as

$$s_{x-y} = \sqrt{(391{,}000)^2 + (385{,}000)^2 - (2)(.45)(381{,}000)(385{,}000)} = 407{,}000$$

The 90-percent confidence interval for the estimated difference between the number of people in poverty for 2001 and 2000 is calculated as 1,326,000 ± 1.645 x 407,000. Because this interval does not contain zero, we can conclude with 90-percent confidence that the number of people below the poverty level in 2001 was higher than the number of people below the poverty level in 2000.

Standard error of a ratio. Certain estimates may be calculated as the ratio of two numbers. The standard error of a ratio, x/y, may be computed using

$$s_{x/y} = \frac{x}{y}\sqrt{\left[\frac{s_x}{x}\right]^2 + \left[\frac{s_y}{y}\right]^2 - 2r\frac{s_x s_y}{xy}} \qquad (4)$$

The standard error of the numerator, s_x, and that of the denominator, s_y, may be calculated using formulas described earlier. In formula (4), r represents the correlation between the numerator and the denominator of the estimate.

For one type of ratio, the denominator is a count of families or households and the numerator is a count of people in those families or households with a certain characteristic. If there is at least one person with the characteristic in every family or household, use 0.7 as an estimate of r. An example of this type is the average number of children per family with children.

For all other types of ratios, r is assumed to be zero. If r is actually positive (negative), then this procedure will provide an overestimate (underestimate) of the standard error of the ratio. Examples of this type are the average number of children per family and the family poverty rate.

Note: For estimates expressed as the ratio of x per 100 y or x per 1,000 y, multiply formula (4) by 100 or 1,000, respectively, to obtain the standard error.

Illustration. Suppose the number of families below the poverty level, x, was 6,813,000 and the total number of families, y, was 74,340,000. The ratio of families below the poverty level to the total number of families would be 0.092 or 9.2 percent. Use the appropriate parameters from Table 3 and formulas (1) and (4) with r = 0 to get

	x	y	ratio
Estimate	6,813,000	74,340,000	0.092
a parameter	0.000052	-0.000005	-
b parameter	1,243	1,052	-
Standard error	104,000	225,000	0.001
90-percent conf. int.	6,642,000 to 6,984,000	73,970,000 to 74,710,000	0.090 to 0.094

Table 5.
CPS Standard Error Parameters for Poverty, Income, and Nonincome Characteristics of Hispanics: 1972 to 1983

Characteristics	1972-1980		1981-1983	
	a	b	a	b
BELOW POVERTY LEVEL				
People				
Total	-0.000063	11,528	-0.001131	12,901
Male	-0.000130	11,528	-0.002307	12,901
Female	-0.000123	11,528	-0.002219	12,901
Age				
Under 15	-0.000052	6,057	-0.001399	6,778
Under 18	-0.000044	6,057	-0.001184	6,778
15 and over	-0.000032	11,528	-0.000421	12,901
15 to 24	-0.000122	4,520	-0.001414	5,058
25 to 44	-0.000097	4,520	-0.000962	5,058
45 to 64	-0.000117	4,520	-0.002147	5,058
65 and over	-0.000153	4,520	-0.006068	5,058
Households, Families, and Unrelated Individuals				
Total	-0.000014	2,420	-0.000237	2,708
ALL INCOME LEVELS				
People				
Total	-0.000020	3,000	-0.000301	3,357
Male	-0.000043	3,000	-0.000615	3,357
Female	-0.000038	3,000	-0.000591	3,357
Age				
15 to 24	-0.000080	3,000	-0.000961	3,357
25 to 44	-0.000065	3,000	-0.000668	3,357
45 to 64	-0.000077	3,000	-0.001459	3,357
65 and over	-0.000147	3,000	-0.004124	3,357
Households, Families, and Unrelated Individuals				
Total	-0.000014	2,420	-0.000237	2,708
Households with children under age 18	-0.000014	2,420	-0.000237	2,708
NONINCOME CHARACTERISTICS				
People				
Employment status	(X)	(X)	(X)	(X)
Educational attainment	-0.000015	2,344	-0.000152	2,623
Total, Marital Status, Other				
Some household members	-0.000026	5,069	-0.000294	5,673
All household members	-0.000044	10,199	-0.000592	11,414
Households, Families, and Unrelated Individuals				
Total	-0.000020	1,626	-0.000022	1,820

Note: Data users should multiply the a and b parameters by 1.5 for nonmetropolitan residence categories. The Census Bureau did not publish income data for Hispanics before 1972.

Source: U.S. Census Bureau, Demographic Statistical Methods Division.

The standard error is calculated as

$$s_{x/y} = \frac{6{,}813{,}000}{74{,}340{,}000}\sqrt{\left[\frac{104{,}000}{6{,}813{,}000,}\right]^2 + \left[\frac{225{,}000}{74{,}340{,}000,}\right]^2} = 0.001$$

The 90-percent confidence interval is calculated as 0.092 ± 1.645 x 0.001.

Standard Errors of Other Estimates. In *Poverty in the United States: 2001*, Table 1 provides confidence intervals for most of the estimates discussed in the text. For other estimates, the standard errors can be estimates using the formulas above. For information on calculating other standard errors, including those for individual states, contact Jana Shepherd at e-mail address: *dsmd.source.and.accuracy@census.gov*.

Table 6.
CPS Standard Error Parameters for Income and Nonincome Characteristics of Asians and Pacific Islanders and American Indians and Alaskan Natives: 2001

Characteristics	a	b
BELOW POVERTY LEVEL		
People	0.000330	5,282
Households, families, and unrelated individuals	+0.000052	1,243
ALL INCOME LEVELS		
People	0.0001 16	1,430
Households, families, and unrelated individuals	0.000101	1,245
NONINCOME CHARACTERISTICS		
People		
Marital status, household, and family characteristics:		
Some household members	0.000238	3,809
All household members	0.000351	5,617
Households, families, and unrelated individuals	0.000077	952

Note: To obtain parameters prior to 2001, multiply the appropriate factor in Table 4. Income data for Asians and Pacific Islanders and American Indians and Alaskan Natives were not collected prior to 1988.

Source: U.S. Census Bureau, Demographic Statistical Methods Division.

Table 7.
CPS Year-to-Year Correlation Coefficients for Income Estimates: 1960 to 2001

Characteristics	Below poverty level								All income levels	
	1972-83 or 1984-2001		1983-84		1971-72		1970-71		1960-2001	
	People	Families	People	Families	People	Families	People	Families	People	Families, households, and unrelated individuals
Total	**0.45**	**0.35**	**0.39**	**0.30**	**0.15**	**0.14**	**0.31**	**0.28**	**0.30**	**0.35**
White	0.35	0.30	0.30	0.26	0.14	0.13	0.28	0.25	0.30	0.35
Black	0.45	0.35	0.39	0.30	0.17	0.16	0.35	0.32	0.30	0.35
Other races	0.45	0.35	0.30	0.30	0.17	0.16	0.35	0.32	0.30	0.35
Hispanic[1]	0.65	0.55	0.56	0.47	0.17	0.16	0.35	0.32	0.45	0.55

[1]Hispanics may be of any race.

Note: These correlations are for comparisons of consecutive years. For comparisons of nonconsecutive years, assume the correlations are zero. For Asians and Pacific Islanders and American Indians and Alaskan Natives, use the correlation coefficient for total. Correlation coefficients for 1983-84 are lower than those for 1982-83 or 1984-85 because of the phase-in of the new sample design. Poverty correlation coefficients for 1999-2000 were affected by the SCHIP sample expansion: for Total, White, Black, Other, and Hispanic they are .29, .23, .23, .22, and .52, respectively, for people and .22, .20, .18, .17, and .40, respectively, for families. The income correlation coefficients were also affected: they are .19, .20, .15, .15, and .36 for people; and .22, .23, .18, 17, and .28 for families, households, and unrelated undividuals.

Source: U.S. Census Bureau, Demographic Statistical Methods Division.